

SPECIFICATION

TREVOR P. ASHLINE

HEAD RESTRAINT DEVICE WITH BACK MEMBER

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/409,085, filed September 9, 2002, and which is hereby incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for controlling a driver's head and neck when subjected to deceleration forces, and more particularly to a device for controlling forward and downward movement of the head and neck of a driver during a frontal crash of a high performance vehicle.

BACKGROUND OF THE INVENTION

Currently, drivers of high performance vehicles use a standard five or six point seat belt assembly, in which all the belts tie into a common buckle, to restrain the driver during a crash. The seat belt assembly constrains the torso of the driver from moving substantially away from the seat during a collision. However, the seat belt assembly does not restrain the driver's head or neck, allowing the head to uncontrollably move forward, then violently downward towards the driver's

chest, particularly when the vehicle is subjected to a frontal impact. This uncontrolled movement of the head has resulted in serious injury and death.

In severe crashes, injury to the driver can occur in three ways. First, while the driver's head is moving forward and downwardly, it can strike against a component of the vehicle. Next, and most importantly, while the driver's head is snapping downwardly, the spine is placed in such high tensions that basal skull injuries can occur. Specifically, the neck at the base of the skull can break. Finally, the driver's neck can recoil from the forward-downward position in such a manner that the back of the driver's head is flung rearward against the seating assembly.

One proposed approach to reduce these injuries is to equip racing vehicles with front airbags. However, this approach is problematic in that after the first impact, the inflated airbag would block the driver's field of vision. Another problem with airbags in race cars is that they would have to deploy more quickly, and with more explosive force, than with conventional vehicles because of the high speed of travel. As such, the airbag itself can cause injury to the driver.

Other efforts to improve safety for high performance vehicle drivers include devices designed to restrain the head and neck of the driver during a collision. Two of these devices, the Hanns Device and the Hutchens Device TM have been mandated by NASCAR as required safety equipment.

The Hanns Device, described in US Patent No. 6,009,566 to Hubbard, includes a rigid yoke

worn by the driver to which a safety helmet is tethered. Unfortunately, because of the rigid bulky yoke, the Hanns Device itself may be a safety hazard by impeding the driver from exiting the vehicle during an emergency situation. With high performance vehicles, egress into and out of the vehicle is through the driver-side window frame. When a vehicle crash occurs it is important that the driver quickly escape from the vehicle. This need to quickly exit the vehicle is particularly critical when the driver and/or vehicle are on fire or the driver is seriously injured. However, since the yoke is stiff and bulky, it can impede the driver from exiting the vehicle by making it more difficult to fit through the driver-side window frame. Consequently, valuable time, in removing the driver from a dangerous crash site, and to treat the driver, may be lost.

Another disadvantage of the Hanns Device is that the driver's seat must be modified to accommodate the bulky yoke. Accordingly, additional expense is incurred and the device cannot be used in vehicles which have not been modified.

A further disadvantage of the Hanns Device is that the rigid bulky yoke is uncomfortable to some drivers and unnecessarily restricts their mobility when operating the vehicle.

The Hutchens Device™, described in US Patent No. 6,499,149, to Trevor P. Ashline, comprises a series of straps forming a harness worn by a driver. The harness is tethered to the driver's helmet and anchored either to the vehicle's seat belt assembly or, in an alternative configuration, around the driver's legs. Although the Hutchens Device™ provides protection during

a collision event, and advantageously allows for the driver to exit the vehicle by merely releasing the vehicle seat belt assembly, there is a continual need to provide improved and/or alternative head restraint devices.

Following are various patents of which the Applicant is aware:

<u>U.S. Patent No.</u>	<u>Inventor</u>	<u>Issue Date</u>	<u>Title</u>
6,499,149 B2	Ashline	12-31-2002	RACE CAR DRIVE HELMET/HEAD RESTRAINT
6,330,722 B1	Betts	12-18-2001	PROTECTIVE HELMET RESTRAINT AND HEAD AND NECK STABILIZING SYSTEM
6,009,566	Hubbard	01-04-2000	HEAD AND NECK SUPPORT FOR RACING
5,437,613	Reggio et al.	08-01-1995	NECK BRACE
5,272,770	Allen	12-28-1993	HEAD RESTRAINING SYSTEM
5,267,708	Monson et al.	12-07-1993	HEAD SUPPORT APPARATUS
4,923,147	Adams et al.	05-08-1990	HEAD SUPPORT/SPINE OFFLOADING EJECTION SEAT INSERT

4,909,459	Patterson	03-20-1990	HELMET-MOUNTED HEAD RESTRAINT
4,638,510	Hubbard	01-27-1987	NECK PROTECTION DEVICE OF A HIGH PERFORMANCE VEHICLE
3,925,822	Sawyer	12-16-1975	SAFETY HARNESS FOR A HELMET
3,671,974	Sims	06-27-1972	FOOTBALL TRAINING HARNESS
<u>International</u> <u>Patent No.</u> WO 93/05986	<u>Inventor</u> Jeong	<u>Issue Date</u> April 1, 1993	<u>Title</u> JACKET STITCHED WITH SAFETY BELT FOR AUTOMOBILE AND FORMED WITH LOOP
<u>U.S. Application</u> <u>Publication No.</u>	<u>Inventor</u>	<u>Issue Date</u>	<u>Title</u>
2001/0002087A1	Townsend	05-31-2002	HELMET RESTRAINT SYSTEM AND METHOD

Ashline, U.S. Patent No. 6,499,149 B2, describes a head and neck restraint device for being worn by a driver while operating a high performance vehicle. The device controls the driver's head from snapping forward in the event of a frontal collision of the vehicle. The device includes a pair of anchor straps worn along the back of the driver, and which are attachable at a first end to a driver's helmet and at a second end to the vehicle's seat belt assembly. A chest strap and a waist strap maintain the device on the driver. Since the device is neither rigid nor bulky, the driver may quickly

exit the vehicle unrestricted by the device.

Betts, U.S. Patent No. 6,330,722 B1, describes a helmet restraint and head stabilizing system for use with a helmet worn by an operator of a vehicle, in conjunction with a shoulder belt system or a suit worn by the operator. The helmet restraint and stabilizing system includes a flexible belt assembly, means for attaching the belt assembly to the shoulder belt system or the suit, means for attaching the belt assembly to the helmet, wherein the belt system has at least two belts connectable by a releaseable connecting means.

Hubbard, U.S. Patent No. 6,009,566, describes a head and neck restraint device for an occupant of a high performance vehicle. The support device includes a restraining yoke and a collar. The restraining yoke has two front portions which extend out from the shoulders of the driver along the torso of the occupant, and also include a rear portion which extends behind the neck and shoulders of the occupant. The collar of the device extends upwards from the rear portion of the restraining yoke, behind the head of the occupant. The collar of the device is connected by tethers to the occupant's helmet. Shoulder belts of the shoulder harness provided in the vehicle extend over the front portion and rear portion of the restraining yoke when the device is mounted on the occupant such that the device is between the shoulder belt and the occupant. The collar acts to transfer forces from the helmet through the tethers to the collar of the restraining yoke, which transfers the forces to the shoulder harness, thereby reducing forces being transmitted to the neck of the occupant.

Reggio, *et al.*, U.S. Patent No. 5,437,613, discloses a neck brace for protecting a user during vigorous activities. The neck brace has an elongated non-stretchable, flexible strap having a pin on one end thereof for attachment to a helmet and a second end secured to a body harness, such that the user can bend his head slightly downward.

Allen, U.S. Patent No. 5,272,770, discloses a head restraining system including a helmet having a chin protector formed thereon, a keeper plate overlying the shoulders, upper chest, including the sternum area, and upper back of the driver, a plurality of straps connecting the shoulder, chest and back portion of the keeper plate to aligned portions of the helmet and a pair of shoulder straps securing the keeper plate to the driver.

Monson et al., U.S. Patent No. 5,267,708, describes a head support apparatus for protecting a subject's head against detrimental effects of acceleration. The apparatus includes a beam housing attachable to a body support device, thereby rigidly supporting the beam housing within a y-z plane, but allowing rotation about an x-axis. The x-axis is defined as extending through the subject's face to the back of the head. The y-axis is defined as extending laterally from ear to ear and the z-axis is defined as extending vertically from the top of the head through the subject's chin. A U-shaped rigid beam is mountable in a channel of the beam housing such that the beam is rigidly supported within the x-y plane but is able to be rotated about the x-axis. Helmet attachments are provided for supporting the helmet relative to the rigid beam within the x-z plane but allowing rotation of the helmet about the y-axis.

Adams et al., U.S. Patent No. 4,923,147 describes a seat insert for a vehicle which maintains an occupant of the vehicle in a forward position during high G-acceleration. The seat insert has a head support member for supporting the occupant's head during a forward, leaning posture. A head support member restraint cord is provided to restrain movement of the head support member during the occupant's forward lean. The top and bottom of the helmet are restrained to the head support member which is behind and above the top of the helmet. The head support member tends to resist motions of the occupant's head which are downward due to accelerations. The seat insert also includes a back plate assembly connected to the head support member for supporting the spine in its natural curvature. The back plate assembly is able to pivot forward relative to the seat of the vehicle. The seat insert is able to transfer G-induced weight from the spine to the back plate assembly and ultimately to the existing seat of the vehicle. The seat insert restrains the driver relative to the seat and must rely on restraint of the torso to be compatible with the head restraint for restraining the head relative to the torso.

Patterson, U.S. Patent No. 4,909,459, describes a head restraint device which connects the helmet of an occupant to a vehicle seat. The head restraint has a restraining strap which applies a single force to the head, to restrain the head from horizontal forward motion, and a strap assembly on the helmet to hold the head upright. The restraining strap pulls the head directly back near the middle of the head and helmet. The restraining strap only applies force when the deceleration forces are above a predetermined level. The attachment of the strap to the helmet allows the helmet to

rotate about a vertical axis approximately 180 degree. The restraint can also be connected to the torso of the occupant to simultaneously retract the head and the torso. The restraint must be detached for the occupant to exit the vehicle.

Hubbard, U.S. Patent No. 4,638,510, discloses a neck protection device for a driver or a high performance vehicle. The device is adapted to reduce motions or loading in the neck and upper torso. The device includes a stiff yoke with a high collar extending up from the yoke and a set of tethers and rear portions of a helmet and collar. The high collar extends upward to adjacent the center of gravity of the head and helmet which is at about eye level of the occupant. The tethers on the collar allow needed head movements and yet reduce the potential for fatigue and crash injury by carrying forces which would otherwise be transmitted through the neck and by reducing extreme motions of the neck.

Sawyer, U.S. Patent No. 3,925,822, discloses a safety harness for securely holding a helmet on the head of a person, such as a motor cyclist to prevent accidental displacement of the helmet from the head even in the case of a severe accident. The safety harness includes a strap arrangement adapted to be worn on the body of the person and which is manually releaseably from the body of the person and from the helmet.

Sims, U.S. Patent No. 3,671,974, discloses a football training harness which has detachable rigid connections that extend from the shoulder pads to the rear of the football helmet to prevent

hyperflexion and bending of the player's head.

Jeong, World Patent No. WO 93/05986, discloses a vest type jacket formed with loops into which safety belts from automobile are passed through. The jacket is fastened to a seat back by belts to prevent a rider from moving away from a seat in event of an collision.

Townsend, U.S. Patent Application Publication No. 2001/0002087, discloses a helmet restraint system which secures the helmet of the occupant in a vehicle to the structural chasis, body, or frame of the vehicle, independent of a shoulder harness or seatbelt. The helmet restraint system reduces potentially injurious forces to the neck and head during a high deceleration event, particularly a frontal collision. The helmet restraint system includes a restraint belt assembly which spans between an anchor point on the vehicle chassis / body and a belt receiving latch mounted to the driver's helmet. The belt is pre-tensioned by an inertially-lockable belt tensioner. The helmet restraint system allows the driver unrestricted head movement during normal driving, but restrains the helmet and head during a collision by locking the belt against further extension. The occupant's helmet is attached to the restraint belt by means of a quick release latch.

OBJECTS OF THE INVENTION

The principal object of the present invention is to provide a device for controlling a driver's head and neck during high-deceleration of a vehicle, particularly a frontal crash of a high

performance vehicle.

Another object of the invention is to provide a device that releaseably attaches a driver's helmet or skull cap to the driver's harness restraint assembly.

Another object of the invention is to provide a device that is carried on the driver.

A further object of the invention is to provide a device that is not bulky.

Another object of the invention is to provide a device that is not affixed to the vehicle.

A further object of the invention is to provide a device that does not interfere with the driver's operation of a vehicle.

Another object of the invention is to provide a device that does not impede egress into or out of a vehicle.

Another object of the invention is to provide a device that transfers forces from a driver's helmet/head to the driver's upper torso during a frontal collision of a vehicle.

Another object of the invention is to provide a device that protects the head and neck during

the rebound phase of a frontal collision, and during a rear collision.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects will become more readily apparent by referring to the following detailed description and the appended drawings in which:

Figure 1 is a front view of a head restraint device with back member according to the preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invented helmet restraint device controls a driver's head and neck during a high-deceleration event, particularly during a frontal collision of a high performance vehicle. The restraint device is self-contained, not requiring attachment to the vehicle's seat belt assembly or any other portion of the vehicle in order to be fully operable. Instead, the restraint device is anchored to the driver's upper torso to restrain the driver's head from uncontrollably snapping forward and downward during a high-deceleration event.

During normal operation, the device does not impede the driver's mobility while operating the vehicle, or while entering or exiting the vehicle. During an impact, the device transfers forces

from the helmet, through the device, to the driver's upper torso to keep the head and neck in general alignment with the spine, thus obviating possible injury otherwise caused by the driver's head snapping forward and downward.

Referring now to Figure 1 of the drawings, the invented restraint device 10 includes a rigid back member 12 positionable to extend along the driver's back from the lower back portion of the helmet. The back member 12 may be planar, or contoured to coincide with the driver's back and neck. A first surface of the back member 12 may be cushioned to comfort the driver from the back member 12.

The back member 12 includes several straps for securing the restraint device 10 to the driver and helmet. "Helmet" is defined to mean any article wearable on the head of the driver, such as a standard racing helmet or a skull cap. The first strap 14 is received through two pairs of slots 15 in a first end of the back member 12 for attachment to the helmet of the driver. The ends of the first strap 14 are provided with quick release clips 16 for easily attachment to, and release from, D-clips affixed to respective left and right halves of the driver's helmet. Alternatively, the first strap may be a pair of straps, each having one end affixed to the back member 12 and an opposed end carrying the quick release clips 16.

A second strap 20, having first and second sections 22, 24, is configured for extending around the torso of the driver in order to secure the device 10 to the driver. One end of the first and

the second sections 22, 24 is attached to the back member 12, while the opposed ends are provided with a means 26, such as a complementary tongue and buckle, for releasably securing the first and second section 22, 24 together. The securing means 26 may also allow for length adjustment to be made to the second strap 20 in order to accommodate different drivers.

Thirds strap 30 joins the first and second straps 14, 20, forming a pair of openings through which the driver's arms and shoulders may be inserted in order to hold the device 10 in proper position on the driver. Stitching, or any other suitable means, may be used to join the straps. Webbing ties may be provided on the third straps 30 for length adjustment.

In use, the device 10 is positioned on the driver by having the driver insert his arms and shoulders through openings formed between the second and third straps 20, 30. The second strap 20 is then coupled around the driver's torso and any necessary length adjustment to this strap 20 is made. The first strap 16 is attached to the helmet D-rings or to a skull cap and any necessary length adjustment is made.

During a frontal deceleration event, forces from the head and helmet are transferred through the first strap 16 and back member 12, causing the third strap 30 to react against the mass of the driver's body. These reactive forces control the driver's head and neck from violently moving forward and downward.

Additionally, the driver is provided protection in involved in the event of a rear collision. During such a collision, the driver's helmet will engage against the back member 12, stabilizing the head.

Furthermore, if the driver is involved in a crash, the restraint device 10 is advantageously not mounted to the vehicle. The driver individually, or assisted by a crew member, simply unlatches the seatbelt assembly in order to unsecure himself from the vehicle. Since the device 10 moves with the driver and is not bulky, the driver can quickly exit the vehicle.

SUMMARY OF THE ACHIEVEMENTS OF THE OBJECTS OF THE INVENTION

From the foregoing, is readily apparent that I have invented a restraint device to protect a driver involved in a collision while operating a high performance vehicle. In the event of such a collision, the device generally maintains the driver's head, neck and spine in alignment, keeping the driver's head from snapping forward and downward. Moreover, as the device is carried on the driver, and is not attached to any component of the vehicle, the driver may easily egress into and out of the vehicle.

It is to be understood that the foregoing description and specific embodiments are merely illustrative of the best mode of the invention and the principles thereof, and that various modifications and additions may be made to the apparatus by those skilled in the art, without

departing from the spirit and scope of this invention, which is therefore understood to be limited only by the scope of the appended claims.